Auto-contouring performances for post-op prostate cancer were similar to those of intact prostate cancer. Compared to similar other study without rectal balloon, rectal DSC was significantly improved with the rectal balloon. Bladder and rectum of post-op endometrium cancer showed improvement as increasing the number of atlas match and reached to modest agreement when the number of atlas match was 5. On the contrast, DSCs of FHs were almost independent on the number of atlas match.

Conclusions: For prostate and endometrium cancer, ABAS could be a useful tool for FHs and rectum with ballooning. CTV, bladder, rectum without ballooning, should be reviewed and may require editing. The placement of a rectal balloon and a strict protocol for bladder voiding could help the auto-contouring process for the prostate patient. Increasing the number of atlas match for bladder and rectum improves accuracy of ABAS, but auto-contouring time increases.

PO-1089

The use of deformable fusion between PET-CT and planning CT for target delineation of extended tumors in SBRT

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Purpose/Objective: Stereotactic body radiotherapy (SBRT) is mainly used on small and well defined targets, thus the clinical experience on treating extended tumor volumes is limited. The feasibility of this approach is still controversial on large volumes, especially for moving targets. The lack of accuracy in target positioning forces the expansion of CTV margins. Target size represents the highest limitation for SBRT, due to the increased complexity necessary to achieve dose constrains for organs at risk (Grimm et al 2011). Several studies show that for many primary tumors ^{18}F-FDG PET-CT has a high sensitivity. When clinically adequate, the opportunity to reduce the target volume on the basis of metabolic activity should be considered. The improvement in deformable imaging registration (DIR) allows to combine CT simulation scans with CT-PET, offering a new strategy in tumor metabolic active area identification and target delineation (Cho et al 2013, Fortin et al 2014). The purpose of this study was to evaluate, when extended targets are considered, the reliability of using PET deformed on planning CT and the chance to reduce the target size based on PET data.

Materials and Methods: Six metastatic patients characterized by large target volumes (100-15400 ml) were selected to undergo SBRT (10 Gy in 3 fx). The patients (2 ovaric, 3 lung and 1 rectum as primary tumor) had metastasis respectively located in abdomen, liver, paracardiac, neck, perirectal and lung regions. PET-CT images and planning CT were separately collected. Both rigid registration (RIR) and DIR were performed, fusing diagnostic CT (PET related) and planning CT. PET voxels were deformed on the basis of the CT-CT fusion and registered with the planning CT. Volumes of 40% for SUV_{max} were collected on RIR and DIR images, by the use of threshold segmentation within a VOI of equal size. Dice similarity coefficient (DSC) was used for conformity evaluation between RIR and DIR (Fortin et al 2014). DSC higher than 0.7 was considered as acceptable level of conformity.

Results: DSC resulted higher than 0.7 only for two patients (DSC=0.80±0.05) and lower for the remaining four patients (DSC=0.31±0.16). Low DCS values were related to a substantial difference between the diagnostic and planning CT, due a different use of immobilization devices, positioning (arms up and down, neck position) or target motion, mainly respiratory.

Conclusions: Since voxel intensity is not preserved in PET-CT deformed images, a high DSC is highly desirable. DSC can be interpreted, more then conformity, as an index of position reproducibility and used as an indication of registration reliability. Our results underlined the importance of adopting the same immobilization device and body positioning in both treatment planning and PET-CT. In this context, we suggest the adoption, as cut off, of DSC value higher than 0.7, when referring to PET-CT images.

PO-1090

Dosimetric impact of brachial plexus delineation in radiotherapy planning of nasopharyngeal carcinoma

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Purpose/Objective: Radiotherapy for patients with nasopharyngeal carcinoma (NPC) may result in high radiation dose to the brachial plexus (BP) resulting in radiation-induced brachial plexopathy (RIBP). In order to control and analyze the radiation dose delivered to the BP, accurate delineation and application of dose constraints during planning optimization are crucial. The aim of this study was to evaluate the radiation dose to BP by following the Radiation Therapy Oncology Group- endorsed contouring atlas (RTOG-eCA) and to analyze the dosimetric consequences on applying dose constraints to BP in tomotherapy planning optimization of NPC.

Materials and Methods: 15 patients with NPC regardless of the staging were retrospectively selected. Both MR and CT images of the neck region for image registration should be available. Apart from original treatment plan (Plan A) in which no dose constraint was applied to BP, two new tomotherapy plans (Plan B & C) were computed using the same set of planning CT images and the same treatment parameters. Plan B consisted of BP contours based on RTOG-eCA while Plan C consisted of BP contours based on MR images registered with the planning CT images. Additional dose constraints to BP were added to both Plan B & C aiming to keep the maximum dose < 60Gy. The end-point was that both Plan B & C achieved the same dose outcome as Plan A, and the Dmax of the non-target BP was kept < 60Gy. The new BP contours based on both CT and MR were also added to Plan A to evaluate whether the original BP dose exceeded the RTOG recommended dose limit using the MIM software. For each patient, dose-volume histograms of the BP for both Plan A, B & C would be generated for dose comparison. BP volumes, Dmax, D_{mean}, $D_{5\%}$, $D_{10\%}$ and $D_{15\%}$ were compared. Contours among Plan B & C on both axial CT slices and corresponding beam's eye views were also compared visually.

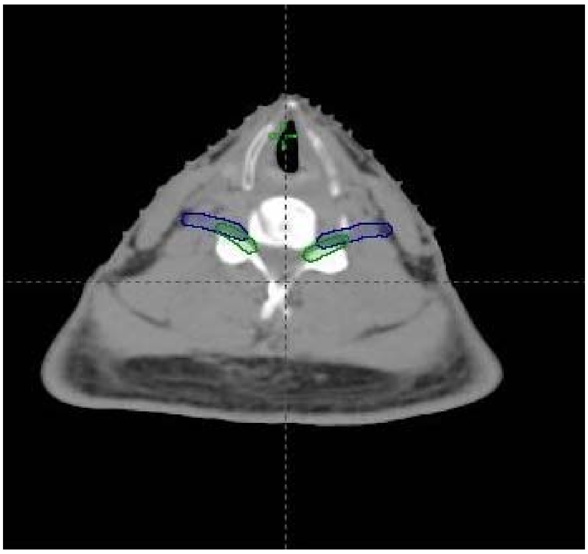

Figure 1 - The overlapping of BP contours based on RTOG-eCA (blue) and MRI (green)

Results: The mean BP volumes were summarized in Table 1. The average Dmax of BP for Plan A & B in which BP contours based on RTOG-endorsed BP contouring atlas were 62.0Gy versus 60.0Gy (left) and 61.6Gy versus 59.9Gy (right). The average Dmax of BP for Plan A & C, in which BP contours based on MRI were 60.8Gy versus 58.6Gy (left) and 60.5Gy versus 58.3Gy (right). There were also significant dose reduction between different Plans on Dmean, D5%, D10% & D15% of both left and right BPs.

	Mean BP volume (cc)	
	Lt	Rt
RTOG-eCA	9.6 (range: 6-12.3)	9.5 (range: 5.8-12.3)
MRI	5.4 (range: 3.1-7.8)	5.0 (range: 3.2-6.4)
Overlapping	1.9 (range: 0.38-4.03) ($p<0.05$)	

Table 1 - Summary of BP volume

Conclusions: Contouring BPs based on RTOG-eCA and MR showed significant difference in term of the overlapping volume. Applying BP dose constraints during tomotherapy plan optimization for NPC patients could significantly reduce the BP dose (Dmax, Dmean, D5%, D10% & D15%) without affecting the doses to targets and other organs-at risk.

PO-1091

Dice Comparison of OAR delineations in the pelvic region between RTT's and RadOnc's: a measure of competence

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Purpose/Objective: Defining OAR used to be a key task for RadOnc's when aiming to optimize the benefit of radiation therapy, with delivery of the maximum dose to the tumour volume while sparing healthy tissues. There has been a trend towards transferring the OAR delineation job to RTT's with delegated responsibility from a RadOnc. To ensure a continuous high level of RTT competence, a system has been developed and used where RTT and RadOnc delineations are compared with the dice coefficient (DC).

Materials and Methods: After education, training and practice with feedback from RadOnc's, 10 RTT's delineated bladder, bowl and rectum on the same patient to evaluate the acquired competences in defining OAR's. As a reference, 6 RadOnc's with different experiences also delineated the same patient. To test the similarity between all the 16 samples, simple DC's where calculated for each organ. Intra RTT and RadOnc DC's are pooled and mean±SD values are calculated as a measure of the intra RTT and RadOnc group consistency. The inter group consistency is also calculated as the mean of the RTT/RadOnc DC's.

Results: The results of all the DC's are shown as boxplots where all the DC's for intra RTT (RTT tested against another RTT) and intra RadOnc are pooled. Also a boxplot for DC's where any RTT's are tested against all RadOnc's is presented in the plot. Bladder is a medium sized well defined organ and as expected the overall DC's are high, indicating very good agreement in all cases. The bladder mean volume for all delineations is 260cc and the intra group means are $DC_{RTT,Bladder}=0.95\pm0.01$and $DC_{RadOnc,Bladder}=0.96\pm0.02$. No significant difference between RTT and RadOnc agreement is observed. A few outliers are however seen in the RTT group and attention has be drawn to the competence of those specific RTT's. The bowl is a relatively large parallel organ which can be difficult to define in the peripheral regions. However due to the large volume, the DC's are rather insensitive to local differences in periphery of the bowl. So even if visual inspection shows large differences in delineation, a relatively large DC is observed. The mean bowl volume is 1461cc and the intra group means are $DC_{RTT,Bowl}=0.86\pm0.04$ and $DC_{RadOnc,Bowl}=0.86\pm0.04$.No significant difference between RTT and RadOnc and no outliers. Rectum is a small curved organ setting high demands on local agreement to achieve high DC's. As expected the general DC is lower than two other organs and there is a significant difference (t-test, $p=0.01$) in the intra agreement of the RTT's and RadOnc's. Rectum mean volume 83cc and the intra group means are $DC_{RTT,Rectum}=0.76\pm0.08$ and $DC_{RadOnc,Rectuml}=0.82\pm0.06$.This difference indicates more training and education of the RTT's and maybe the OAR delineation protocol needs adjustments.